INFLUENCE OF BUBBLES ON NAVAL SYSTEMS OPERATING IN SHALLOW WATER: THE SCRIPPS PIER EXPERIMENT

Peter H. Dahl
Applied Physics Laboratory
College of Ocean and Fisheries Sciences
University of Washington
Seattle, Washington 98105
Telephone: (206) 543-2667
Fax: (206) 543-6785
E-Mail:dahl@apl.washington.edu
Award #: NAVSEA Contract N00039-96-D-0061, Task Order #2206002
Category of Research: high-frequency scattering, volume scattering

LONG-TERM GOALS

To predict the effects of bubbles, especially very high void fractions characteristic of surf zone regions, on MCM and weapons systems.

OBJECTIVES

The primary objective of the experiment was to measure properties of a bubble field, such as its spatial and temporal scales, its density, and its size distribution, within a near-shore environment. Data from this and future experiments will be interpreted along with the coastal oceanography and used to model the effect of bubbly environments on sonar system performance.

APPROACH

A collaborative, multi-institute experiment was performed in the vicinity of the Scripps Pier during Feb-March 1997, whose goal was the study of bubble field generation, transport, and distribution, as influenced by surf zone conditions. The collaboration involving NRL-SSC, IOS, APL-UW, SIO, NCPA, and NRL-DC, produced an ensemble of instrumentation at the site for measuring bubbles, ambient noise, temperature and salinity, currents and surface waves. APL-UW deployed an array of four upward-looking transducers (frequency 240kHz), which simultaneously measure vertical profiles of acoustic volume scattering from bubbles from four locations.

WORK COMPLETED

The Scripps Pier experiment and preliminary results of data analysis [1] were completed this year.

RESULTS

The transport of bubbles via rip currents emerged as a key feature surf zone bubble environment [1]. Images of volumetric backscattering strength vs time and depth (Fig. 1) reveal episodic events (by way of increased scattering level) which last O(100) s and can occur in intervals of O(10) min. Time lags for increased scattering at the four APL-UW locations were consistent with a seaward flow of rip currents equal to about 0.25 m/s.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 1997		**00-00-1997 to 00-00-1997**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Influence of Bubbles on Naval Systems Operating in Shallow Water: The Scripps Pier Experiment	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **University of Washington,Applied Physics Laboratory,1013 N.E. 40th Street,Seattle,WA,98105**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**3**	

IMPACT / APPLICATIONS

Data from the Scripps Pier Experiment are the most comprehensive to date that have been gathered in the surf zone environment. Results of this and perhaps future experiments this kind will no doubt have a strong influence on the design of sonar systems that must operate in very shallow water or surf zone environments.

TRANSITIONS

The results will be particularly useful to programs that address the influence of bubbles on naval systems operating near the sea surface, in the shallow water surf zone, or in vicinity of ship wakes.

RELATED PROJECTS

The work relates to other efforts within the ONR program entitled “Influence of Bubbles on Naval Systems Operating in Shallow Water”, being carried out by NRL-SSC, IOS, and SIO-MPL.

REFERENCES

[1] P. H. Dahl, ``Report on the Scripps Pier Bubble Experiment, Spring 1997," APL-UW TM 3-97, April 1997.

Fig.1 Depth vs time display of Sv (in decibels) as measured at 240kHz during coordinated Run 7 of the Scripps Pier Experiment. The plots are arranged such that their order, from top to bottom, represents the seaward direction, or increasing distance from shore. The abrupt increase in scattering level at minute 2.5 in the top plot is interpreted as a bubble cloud that subsequently spans the area delimited by the four transducer locations.